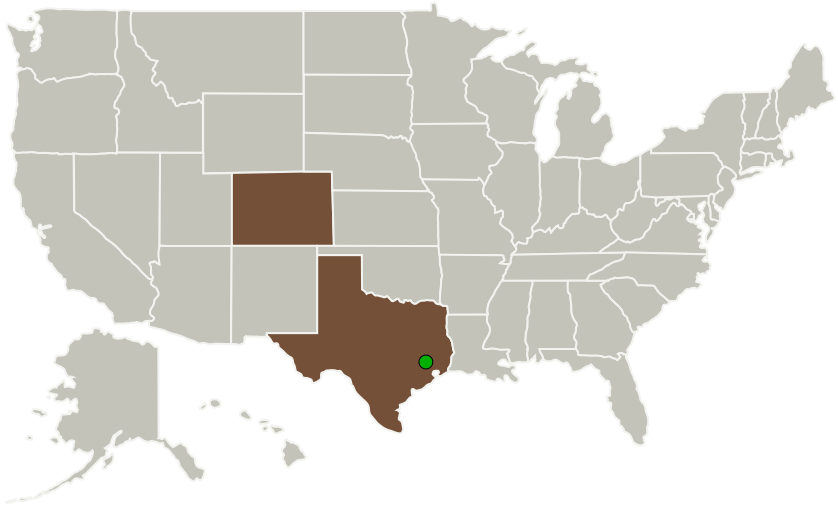
Mars Regolith Water Extractor, Phase I

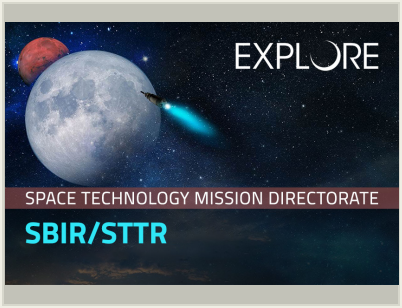
Completed Technology Project (2011 - 2011)

Project Introduction

The Mars Regolith Water Extractor (MRWE) is a system for acquiring water from the Martian soil. In the MRWE, a stream of CO2 is heated by solar energy or waste heat from a nuclear reactor and then passed through a vessel containing Martian soil freshly removed from the ground. The hot CO2 will cause water absorbed in the Martian soil to outgas, whereupon it will be swept along by the CO2 to a condenser chamber where ambient Martian cold temperatures will be used to condense the water from the CO2. The CO2 is then pumped back to the heater where it is reheated and recirculated back to the soil vessel to remove more water. Measurements taken by the Viking mission showed that randomly gathered Martian soil contains at least 1% water by weight, and probably more than 3%. This being the case, the MWRE should prove to be a highly effective way of acquiring water on Mars. By doing so, it will eliminate the requirement to transport hydrogen to Mars in order to make methane fuel, and allow all the propellant needed for a Mars to Earth return flight to be manufactured on Mars using a Sabatier/electrolysis (S/E) cycle, without any need for auxiliary oxygen production through zirconia cells, reverse water gas shift cycles, or other systems. This is highly advantageous since the S/E cycle is the simplest and easiest to implement of all Mars in-situ propellant production methods. The ability to extract water from Mars will also serve to supply the crew of a Mars missions with copious supplies of water itself, which after propellant, is the most massive logistic component of a Mars mission. By eliminating the need to transport fuel, oxygen, and water to Mars, the MWRE will have a major effect in reducing the mass, cost, and risk or human Mars exploration.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Pioneer Astronautics	Lead Organization	Industry Historically Underutilized Business Zones (HUBZones)	Lakewood, Colorado
Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations	
Colorado	Texas

Project Transitions

February 2011: Project Start

September 2011: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138287)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Pioneer Astronautics

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Robert M Zubrin

Co-Investigator:

Robert Zubrin

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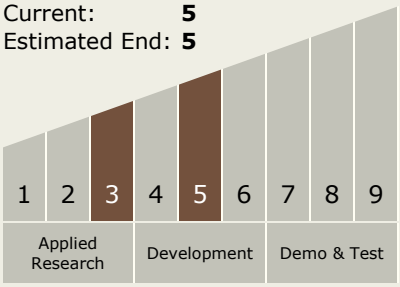
Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX07 Exploration Destination Systems
  - TX07.1 In-Situ Resource Utilization
    - TX07.1.3 Resource Processing for Production of Mission Consumables

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System